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FLOOD INSURANCE STUDY

ORIGINAL
COMPLETED
33.

CITY OF POQUOSON, VIRGINIA
INDEPENDENT CITY

MAY 15, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 510183

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FLOOD INSURANCE STUDY
CITY OF POQUOSON, VIRGINIA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Poquoson, Virginia, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The original hydrologic and hydraulic analyses for this study were performed by the Norfolk District of the U. S. Army Corps of Engineers for the Federal Emergency Management Agency (FEMA). The original work was completed in 1975.

This study was revised to include a wave height analysis by Dewberry & Davis for FEMA, under Contract No. EMW-C-0543. The revised work was completed in December 1982.

A second revision to incorporate the effects of marsh grass was performed by Dewberry & Davis for FEMA, under Contract EMW-C-0968. This revision was completed in September 1985.

1.3 Coordination

During the course of the original study, a search for basic data was made at all levels of government. Several meetings were held during the preparation of the original study with representatives of FEMA, the U. S.

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Army Corps of Engineers (COE), the Virginia State Water Control Board, and local officials. Contacts with various agencies were made to minimize possible hydraulic and hydrologic conflicts.

Through the assistance and cooperation of the U. S. Geological Survey (USGS), the National Weather Service, C. K. Tudor Engineers, The Times Herald, and private citizens, useful data for the preparation of the original study were supplied.

On April 2, 1976, the results of the original study were reviewed at a final Consultation and Coordination Officer's (CCO) meeting attended by representatives of FEMA, the city, and the COE.

A study was conducted to revise the Flood Insurance Rate Map for the City of Poquoson to include the effects of wave action. The Virginia Bureau of Water Control, the Virginia Department of Mineral Resources, the Virginia Department of Transportation, the COE, Air Photo Graphics of Purcellville, Virginia, Photo Science Incorporated of Gaithersburg, Maryland, and the City of Poquoson were contacted for data.

The results of this study were reviewed at a final CCO meeting on March 26, 1982, by representatives of FEMA, the City of Poquoson, and Dewberry & Davis.

The current revision was conducted to include the dissapative effects of marsh grass on wave heights. During the course of this revision, valuable data were supplied by the City of Poquoson.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Poquoson, Virginia. The area of study is shown on the Vicinity Map (Figure 1).

Coastal flooding including its wave action from the Chesapeake Bay was studied by detailed methods. This revision was performed to reflect the effects of a marsh grass analysis on the City of Poquoson. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

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FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF POQUOSON, VA.

(INDEPENDENT CITY)

APPROXIMATE SCALE

3 0 3 6 9 12 15 18 21 MILES

VICINITY MAP

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2.2 Community Description

The City of Poquoson is located in the southeastern portion of Virginia. It is bordered by the Chesapeake Bay to the north and east, the City of Hampton to the south, and York County to the west. The city encompasses an area of 29.5 square miles and had a population of 5,441 in 1970. Poquoson became a town by referendum in 1952 and a city in July 1975.

The climate of the city is characterized by moderately warm summers with temperatures averaging approximately 78 degrees Fahrenheit (°F) in July. The winters are cool with temperatures averaging approximately 41°F in January. The average annual precipitation is approximately 43 inches. Snowfall is infrequent, generally occurring in light falls which usually melt and disappear within 24 hours.

The topography of the Poquoson area is typical of the lower Tidewater area bordering the Chesapeake Bay and Hampton Roads harbor. The terrain is generally flat and featureless. There are numerous inlets, marshes, and creeks forming the many peninsulas of development. Land elevations in many of these developed areas seldom exceed five feet in elevation; the major portion of the city is less than seven feet. There are no protective barriers such as sand dunes or continuous seawalls between the developed portions of the city and the surrounding waters. Consequently, any increase in the tide produces flooding to the same level in the community.

The Chesapeake Bay, the Poquoson River, the Back River, the Northwest Branch Back River, and Lamb Creek are the major waterbodies in the area. Fluctuations in the surrounding water levels produce a mean range of tide of approximately 2.4 feet. The timing or coincidence of maximum surge-producing forces with the normal high tide is an important factor in the consideration of flooding from tidal sources.

2.3 Principal Flood Problems

Two general types of storms, hurricanes and northeasters, affect Poquoson, with hurricanes the most severe type. A study of tracks of all tropical storms for which there is a record indicates that, on an average of once a year, a tropical storm of hurricane force passes within 250 miles and poses a threat to Poquoson. While hurricanes can affect the area from May through November, nearly 80 percent occur in the months of August, September, and October. Approximately 40 percent occur in September. The most severe hurricane to strike the study area occurred in August 1933. Other notable hurricanes occured in September 1933, September 1936, and September 1960.

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Northeasters are characterized by strong onshore winds from the northeast. These storms originate with little or no warning along the middle and northern Atlantic coast. They occur most frequently in the winter but can happen at any time. Accompanying winds are not of hurricane force but are persistent, causing above-normal tides for long periods of time. The March 1962 northeaster was the worst to ever hit the study area.

The depth of flooding during these storms depends on the velocity, direction, and duration of the wind and astronomical tide. The duration of flooding depends on the duration of tide-producing forces. Floods caused by a hurricane are usually of much shorter duration than those caused by a northeaster. Flooding from hurricanes rarely lasts more than one tidal cycle; whereas, flooding caused by northeasters may last several days, during which the most severe flooding takes place at the time of the peak astronomical tide.

The shoreline of Poquoson is affected by wave action during large tidal floods, resulting in erosion and damage to boats, equipment, and shore-front structures. Waves are generated by wind action on the surface of the water. Wave heights at any given location are dependent on the velocity, direction, and duration of the wind and the length, width, and depth of water over which the wind is acting.

Poquoson has experienced major storms since the early settlement of the area. Historical accounts of severe storms in the Hampton Roads and Peninsula area date back several hundred years. The following paragraphs discuss some of the larger known floods which have occurred in recent history. This information is based on newspaper accounts, historical records, field investigations, and routine data collection programs normally carried out by the Norfolk District of the COE.

August 23, 1933, Hurricane

The eye of tnis hurricane passed directly over the Hampton Roads area, then moved north up the west side of the Chesapeake Bay. The maximum storm surge produced was the greatest on record and occurred approxi-mately three hours before, but persisted through, the peak of the astronomical tide. In addition to damage from tidal flooding, much damage was caused to roofs, communication lines, and other structures by the high wind. Damage of this nature is characteristic of that to be expected during hurricanes.

Excerpts from The Times-Herald, August 24, 1933:

"The whole shore line from Back River Light to N. Newport News was under water...."

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"Probably the heaviest damage was sustained by the seafood industry. Oyster beds were demolished, nets set for the fall fishing were carried away."

"Langley Field - Headquarters Force was called to the administrative building to await high tide...streets throughout the post were flooded."

September 18, 1936, Hurricane

The eye of this hurricane passed approximately 20 miles east of Cape Henry on the morning of September 18. High tides and gale force winds caused much damage throughout the lower Chesapeake Bay area as the storm moved off to the northeast.

Excerpts from "75 Years of Hurricanes in Norfolk", Fleet Weather Center, Naval Air Station, Norfolk, Virginia:

"On the 17th (while the hurricane was approaching Hatteras) the wind which was from the northeast, increased in velocity from 6 mph in the morning to 23 mph by noon and 33 mph at midnight. Pressure started falling around noon....By 0800 on the 18th the wind had shifted to the northwest and velocity increased to 56 mph with an extreme velocity of 70 mph. 0800 was also the time of the lowest pressure (29.31 inches) at Norfolk as the center passed 20 miles east of Cape Henry."

April 11, 1956, Northeaster

This storm produced a steady northeast wind in the Hampton Roads area for approximately 30 hours. The tides ran 4 feet above normal for approximately 12 hours producing a maximum flood crest of 5.8 feet on the morning of April 11. Large areas of low-lying sections of the city were inundated during this storm.

March 6-8, 1962, Northeaster

The most recent flood of major proportions in the area occurred during the northeaster of March 6-8, 1962. Disastrous flooding and high waves occurred all along the Atlantic Seaboard from New York to Florida. This flood was unusual even for a northeaster since it was caused by a low pressure cell which moved from south to north past Hampton Roads and then reversed its course, moving again to the south and bringing with it huge volumes of water and high waves which battered the mid-Atlantic coast for several days. The photographs shown in Figures 2-5 are views of the flooding during this storm. They are typical of the flooding conditions which occur during major storms.

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Figure 2. Intersection of Poquoson Avenue and N. Lawson Road

Figure 3. Intersection of Ridge Road and Poquoson Avenue

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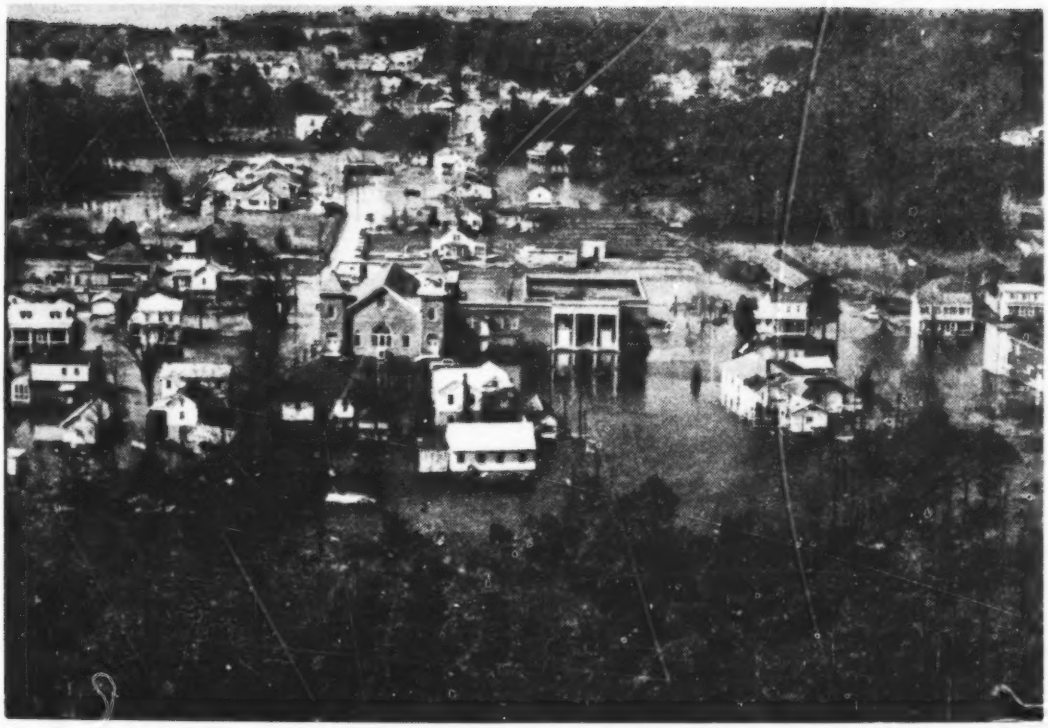

Figure 4. Intersection of Poquoson Avenue and Church Road

Figure 5. Intersection of Messick Road and Poquoson Avenue

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Excerpts from The Times Herald, March 7, 1962:

"Poquoson and its various communities, Messick in particular, literally waded out of the wash of its worst flooding condition in 29 years today as waters from the Chesapeake Bay, Back River and the Poquoson River left a wake of high waters in stores, homes and public facilities."

"Life in the "island" community, cut off from the rest of the Peninsula, despite the Tabb and Wythe Creek Rd. arteries, was at a virtual standstill as the severest storm since the tidal waves of August 1933 moved in to the area, shutting off electricity and communications."

"Worst damage in Poquoson and southeastern areas of York County was done in the Messick area of the present town of Poquoson, where dozens of families were evacuated by boat and high-wheeled trucks from flooded homes."

"Early afternoon reports trickling in from the Messick area had small boats continuously moving through the community, shuttling entire families to higher ground and neighbor's homes."

"Cars were stalled on all roads leading into Poquoson, and small boats were navigating on Poquoson Ave., the main artery of the town."

"The tide level had held to its high for more than an hour. Homes were flooded along Freeman Dr., Ridge Rd., Messick Rd. and Poquoson Ave. down to Amorys Wharf on the northwest branch of Back River."

2.4 Flood Protection Measures

There are no existing flood control structures that would provide protection during major floods in the study area. The "Uniform Statewide Building Code", which went into effect in September 1973 states, "where a structure is located in a 100-year flood plain, the lowest floor of all future construction or substantial improvement to an existing structure ..., must be built at or above that level, except for non-residential structures which may be floodproofed to that level." These requirements will no doubt be beneficial in reducing future flood damage in the city.

3.0 ENGINEERING METHODS

For the flooding source studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special

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significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Analyses were carried out to establish the peak elevation-frequency relationships for the flooding source studied in detail affecting the community.

Stillwater elevations used in this study were developed by Dewberry & Davis (Reference 1). These elevations were developed from the following sources of data: intermittent and continuous tide gage records for six locations in the general vicinity of the Cities of Norfolk, Hampton, and Poquoson for the period between 1906 and 1977; observed tidal flood elevations for tropical and extratropical storms and hurricanes which occurred between 1928 and 1976; and a storm surge model analysis for the Chesapeake Bay completed by the Virginia Institute of Marine Science in 1978 (Reference 2). Table 1 summarizes these stillwater elevations.

TABLE 1 - SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
CHESAPEAKE BAY				
At northern shoreline of community	5.5	7.1	7.7	9.0
At eastern shoreline of community	5.6-5.7	7.3-7.6	7.8-8.3	9.1-9.6
At southern shoreline of community	5.8	7.8	8.5	9.8

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3.2 Hydraulic Analyses

Hydraulic analyses, considering storm characteristics and the shoreline and bathymetric characteristics of the flooding source studied, were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along the shoreline.

Areas of coastline subject to significant wave attack are referred to as coastal high hazard zones. The COE has established the 3-foot breaking wave as the criterion for identifying the limit of coastal high hazard zones (Reference 3). The 3-foot wave has been determined as the minimum size wave capable of causing major damage to conventional wood frame veneer structures.

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in the National Academy of Sciences (NAS) report (Reference 4). This method is based on three major concepts. First, depth-limited waves in shallow water reach a maximum breaking height that is equal to 0.78 times the stillwater depth, and the wave crest is 70 percent of the total wave height above the stillwater level. The second major concept is that the wave height may be diminished by the dissipation of energy due to the presence of obstructions such as sand dunes, dikes, seawalls, buildings, and vegetation. This study incorporates the effects of marsh vegetation on wave heights as described in Procedures for Applying Marsh Grass Methodology (Reference 5). The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by procedures described in References 4 and 5. The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.

These concepts and equations were used to compute wave heights and wave crest elevations associated with the 100-year storm surge. Accurate topographic, land-use, and land-cover data are required for the wave height analysis. Maps of the shoreline areas at a scale of 1:4,800 with a contour interval of 2 feet were used for the topographic data (Reference 6). The land-use and land-cover data were obtained from aerial photographs (Reference 7).

Wave heights were computed along transects (cross-section lines) that were located along the coastal areas, as illustrated in Figure 6, in accordance with the User's Manual for Wave Height Analysis (Reference 8). The transects were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality. Transects were spaced close together in

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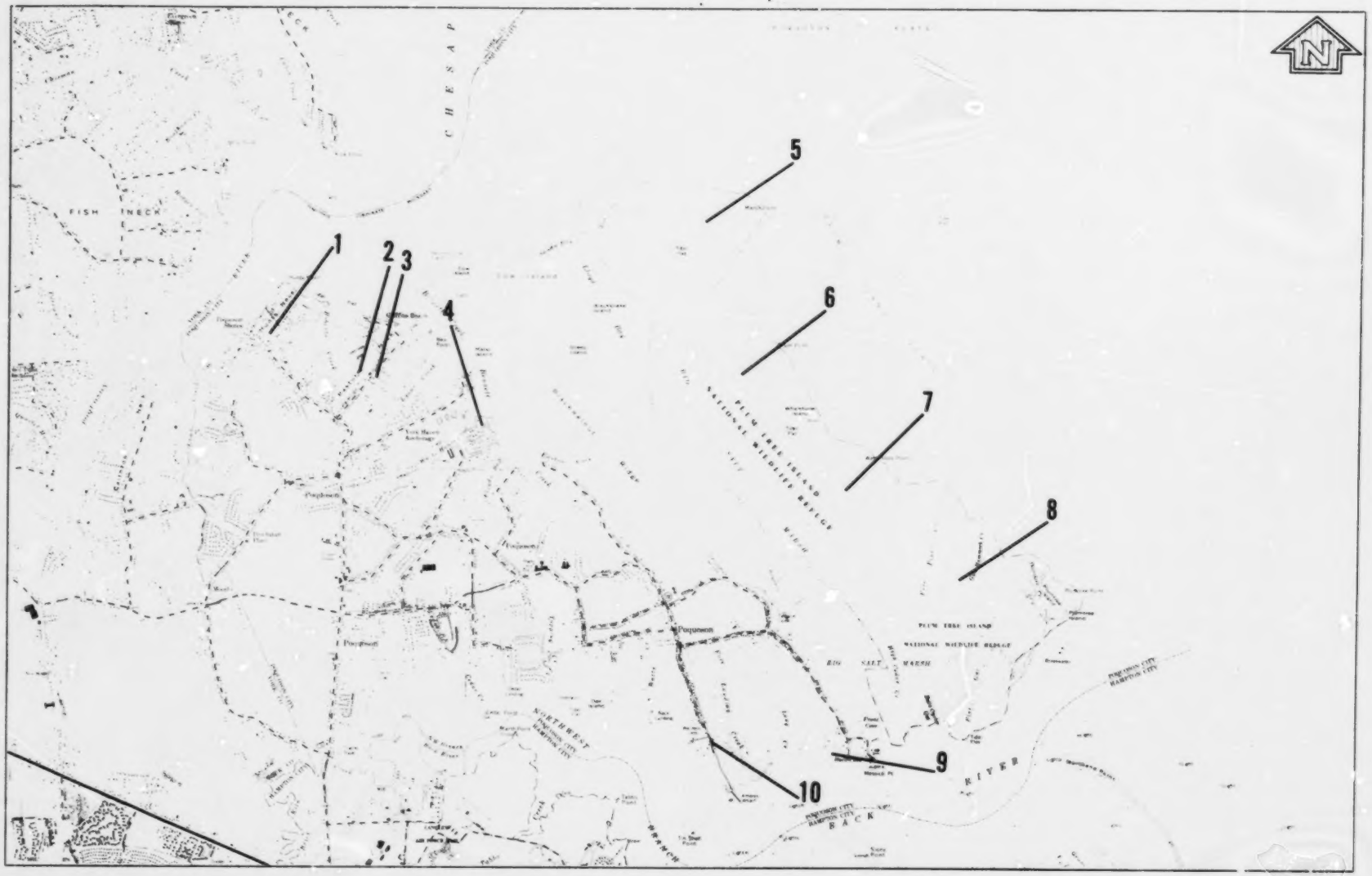

FIGURE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF POQUOSON, VA
(INDEPENDENT CITY)

APPROXIMATE SCALE

5700 0 5700 11400 17100 FEET

TRANSECT LOCATION MAP

12.

areas of complex topography and dense development. In areas having more uniform characteristics, they were spaced at larger intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects. Table 2, "Transect Descriptions," provides a listing of the transect locations and stillwater elevations, as well as initial wave crest elevations.

TABLE 2 - TRANSECT DESCRIPTIONS

Transect	Location	Elevation (feet) Stillwater 100-year	Elevation (feet) Maximum Wave Crest 100-year
No. 1	Western corporate limits to Roberts Creek	7.7	12
No. 2	Roberts Creek to Griffins Beach	7.7	12
No. 3	Griffins Beach to Bay Point	7.7	12
No. 4	Bay Point to Cow Island	7.7	11
No. 5	Cow Island to Marsh Point	7.8	12
No. 6	Marsh Point to Whalebone Island	7.9	12
No. 7	Whalebone Island to Fire Pine Creek	8.1	12
No. 8	Fire Pine Creek to Plumtree Point	8.3	12
No. 9	Plumtree Point to Messick Point	8.5	12
No. 10	Messick Point to Tin Shell Point	8.5	11

Each transect was taken perpendicular to the shoreline and extended inland to a point where wave action ceased. Along each transect, wave heights and wave crest elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The 100-year stillwater elevations were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave crest elevations were determined at whole-foot increments along the transect. The location of the 3-foot breaking wave for determining the terminus of the V zone (area with velocity wave action) was also computed at each transect.

Figure 7 is a profile for a typical transect illustrating the effects of energy dissipation and regeneration on a wave as it moves inland. This figure shows the wave crest elevations being decreased by obstructions, such as buildings, vegetation, and rising ground elevations, and being increased by open, unobstructed wind fetches. Actual wave conditions in the county may not include all the situations illustrated in Figure 7.

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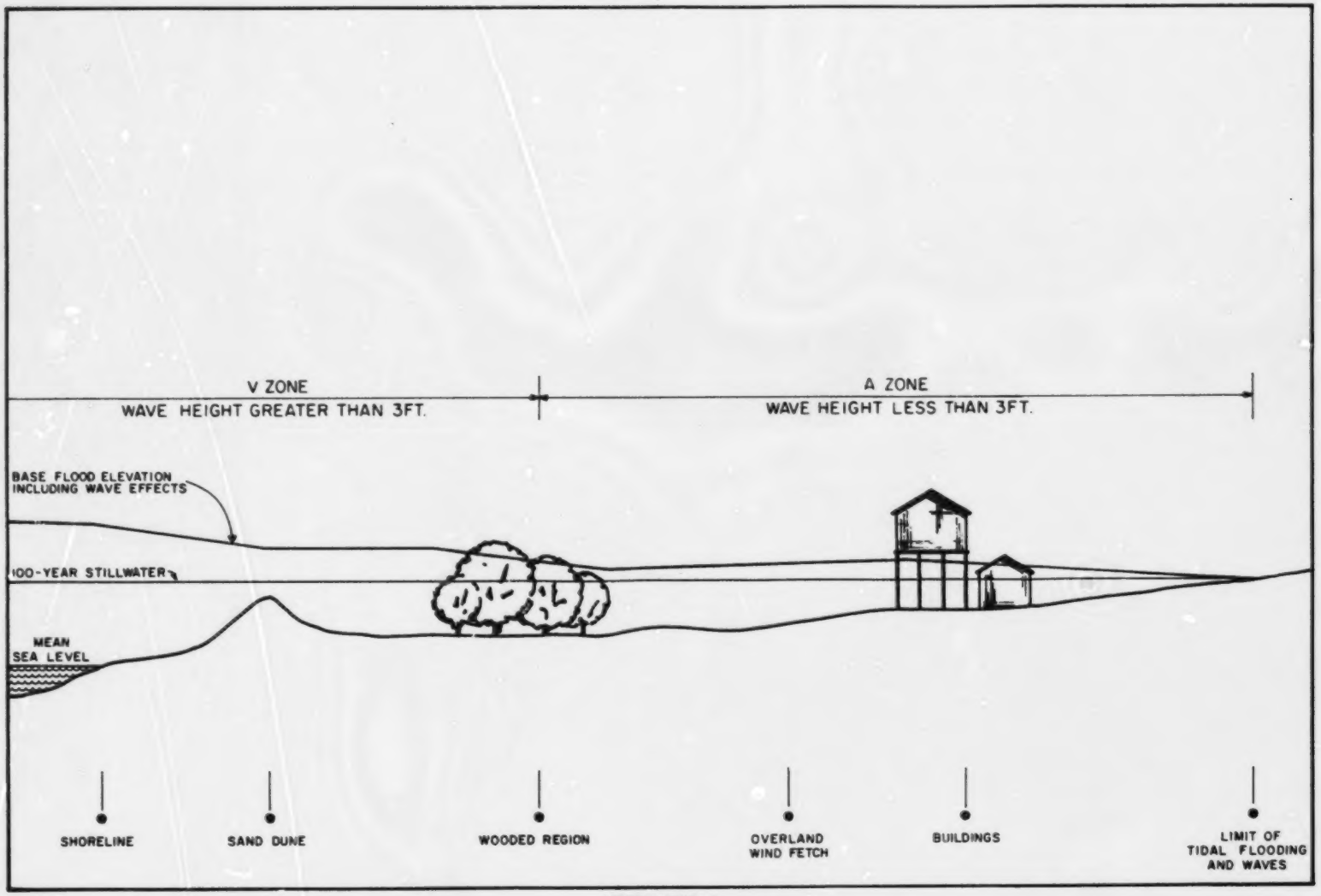

FIGURE 7
TYPICAL TRANSECT SCHEMATIC

After analyzing wave heights along each transect, wave crest elevations were interpolated between transects. Various source data were used in the interpolation, including the topographic work maps, notes and photographs taken during field inspection, and engineering judgment. Controlling features affecting the wave crest elevations were identified and considered in relation to their positions at a particular transect and their variation between transects. The results of the calculations are accurate until local topography, vegetation, or cultural development within the county undergo any major changes. The results of this analysis is summarized in Table 3.

TABLE 3 - TRANSECT DATA TABLE

Flooding Source	Stillwater Elevation 10-Year	Stillwater Elevation 100-Year	Base Flood Elevation (Feet NGVD)*
Chesapeake Bay			
Transect 1	5.5	7.7	10-12 8-10
Transect 2	5.5	7.7	10-12 8-10
Transect 3	5.5	7.7	10-12 8-10
Transect 4	5.5	7.7	10-11 8-10
Transect 5	5.6	7.8	10-12 8-10
Transect 6	5.6	7.9	10-12 8-10
Transect 7	5.7	8.1	10-12 8-10
Transect 8	5.7	8.3	11-12 10
Transect 9	5.8	8.5	11-12 9-11
Transect 10	5.8	8.5	11 9-11

*Due to map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 1).

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4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year flood plain boundaries and 100-year floodway to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For the flooding source studied in detail, the 100- and 500-year flood plain boundaries have been delineated using topographic maps at a scale of 1:4,800 with a contour interval of 2 (Reference 6).

The 100- and 500-year flood plain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year flood plain boundary corresponds to the boundary of the areas of special flood hazards (Zone VE), and the 500-year flood plain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year flood plains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown in this area.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year flood plains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

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Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99

Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year flood plain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or depths are shown.

Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal flood plains that have additional hazards associated with storm waves. Zone V areas are determined by approximate methods, and base flood elevations are not shown.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal flood plains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year flood plain, areas within the 500-year flood plain, and to areas of 100-year shallow flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

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6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and flood plain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year flood plains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For flood plain management applications, the map shows by tints, screens, and symbols, the 100- and 500-year flood plains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

The Flood Insurance Study for the City of Hampton has been completed (Reference 9). The results of this study are in exact agreement with the results of that study.

The results of this study supersede the previous Flood Insurance Study published for the City of Poquoson (Reference 10).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, Regional Director, Region III Office, Liberty Square Building (Second Floor), 105 South Seventh Street, Philadelphia, Pennsylvania 19106.

9.0 BIBLIOGRAPHY AND REFERENCES

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7. Aerial Photographs, Scales 1:7,200 and 1:16,800: Poquoson, Virginia, January and February 1985.

8. Federal Emergency Management Agency, User's Manual for Wave Height Analysis, Washington, D. C., February 1981.

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10. Federal Emergency Management Agency, Flood Insurance Study, City of Poquoson, Independent City, Virginia, Washington, D. C., August 15, 1983.

U. S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 5 Feet: Hampton, Virginia, 1965, Photorevised 1980; Newport News North, Virginia, 1965, Photorevised 1979; Poquoson East, Virginia, 1964, Photorevised 1979; Poquoson West, Virginia, 1965, Photorevised 1979.

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EXHIBIT 1 - ELEVATION REFERENCE MARKS

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 1	03	10.3	The reference mark is a railroad spike in a power pole (VEPCO No. JE-76) located on Hunt's Neck Road about 400 feet southeast of the intersection of Hunt's Neck Road and Edwards Road. The spike is about 1 foot above the ground.
RM 2	03	8.7	The reference mark is a railroad spike in a power pole (VEPCO No. 533-8) located on Hunt's Neck Road about 250 feet northwest of Susan Drive. The spike is about 1 foot above the ground.
RM 3	03	7.0	The reference mark is a railroad spike in a power pole (VEPCO No. 534-31) located on Hunt's Neck Road about 0.3 mile south of Pasture Road at a small creek in the bend of the road. The spike is about 2 feet above the ground.
RM 4	03	7.8	The reference mark is a drill hole in the southwest corner of the concrete floor of the Sewage Pumping Station located along Hunt's Neck Road about 200 feet north of Yorktown Road.

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EXHIBIT 1 - ELEVATION REFERENCE MARKS

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 5	03	10.1	The reference mark is a railroad spike in a power pole (VEPCO No. 494-63) located 0.25 mile south of Kelsor Road on Wythe Creek Road. The spike is about 18 inches above the ground
RM 6	03	9.6	The reference mark is a railroad spike in a power pole (VEPCO No. 494-66B) located at the intersection of Whitehouse Circle and Poquoson Avenue. The spike is about 1 foot above the ground.
RM 7	04	4.1	The reference mark is a drill hole located in the northeast corner of a concrete drain inlet northwest of the intersection of Bayview Drive and Poquoson River Drive.
RM 8	04	4.3	The reference mark is a drill hole in the top of the concrete curb near the intersection of Bayview Drive and Harbor Drive. It is located on the southwest side of Harbor Drive and about 15 feet west of the concrete drain inlet.
RM 9	04	9.5	The reference mark is a railroad spike in a power pole (VEPCO No. KC-76) located on Hunt's Neck Road about 25 feet northwest of the intersection of Hansom Drive and Hunt's Neck Road. The spike is about 1 foot above the ground.

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EXHIBIT 1 - ELEVATION REFERENCE MARKS

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 10	04	7.3	The reference mark is a railroad spike in a power pole (VEPCO No. 534-71) located at the intersection of Pasture Road and Wilson Drive. The spike is about 1 foot above the ground.
RM 11	06	10.4	The reference mark is a railroad spike in a power pole (VEPCO No. 0872) located on Wythe Creek Road about 100 feet south of Hudgins Road. The power pole is located between Sarah Hogge Seafood Restaurant and the 7-11 store. The railroad spike is about 1 foot above the ground.
RM 12	06	6.8	The reference mark is a railroad spike in a power pole (VEPCO No. UD11) located on Odd Road about 400 feet southwest of S. Terrace Drive. The spike is about 1 foot above the ground.
RM 13	06	9.4	The reference mark is a drill hole located in the northwest corner of the concrete floor of the Sewage Pumping Station located on Little Florida Road about 200 feet east of Wythe Creek Road.

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EXHIBIT 1 - ELEVATION REFERENCE MARKS

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 14	06	8.55	The bench mark is located about .35 mile south along Wythe Creek Road from the intersection of Little Florida Road, to Oxford Run, about 20 feet south of Oxford Run and about 50 feet east of Wythe Creek Road, in the northwest corner and flush with the concrete floor of the Sewage Pumping Station (U.S.G.S) A266 Reset 1975).
RM 15	07	11.667	The bench mark is about 300 feet south along Poquoson Avenue from the intersection of Odd Road, in the south face of the brick building, 1 foot east of the front door entrance, and 4.5 feet above the cement porch. The building is located at 777 Poquoson Avenue and now houses Poquoson Electronics (U.S.G.S C266 1942).
RM 16	07	7.7	The reference mark is a drill hole located in the south corner of the concrete floor of the Sewage Pumping Station located on Odd Road about 300 feet northeast of S. Terrace Drive.
RM 17	07	5.5	The reference mark is a large nail in a power pole (VEPCO No. AE-45) located on the west side of Cedar Road, 50 feet south of Municipal Drive. The nail is about 6 inches above the ground.

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EXHIBIT 1 - ELEVATION REFERENCE MARKS

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 18	07	5.73	The bench mark is a Corps of Engineers Survey Mark Disk set in concrete about 1 inch below ground surface, stamped "Tidal BM No. 5 1975 Norfolk District." The mark is 0.02 mile east along Virginia Route 172 from Poquoson Post Office to Cedar Road, 0.5 mile south along Cedar Road to the intersection with Little Florida Road, near the south boundary of 257 Little Florida Road, 24.5 feet north of the centerline of Little Road, and 30 feet east of the centerline of Cedar Road.
RM 19	07	7.51	The bench mark is a Corps of Engineers Survey Mark Disk, stamped "Tidal BM No. 4 1975 Norfolk District." The mark is 0.02 mile east along Virginia Route 172 from Poquoson Post Office to Cedar Road, 1.05 miles south along Cedar Road to the Sewage Pumping Station, 1.5 feet east of the west edge and 0.9 foot north of the south edge and flush with the concrete floor of the Sewage Pumping Station.

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EXHIBIT 1 - ELEVATION REFERENCE MARKS

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 20	07	4.63	The bench mark is a Corps of Engineers Survey Mark Disk set in concrete about 1 inch below the ground surface, stamped "Tidal BM No. 3 1975 Norfolk District." The mark is 0.02 mile east along Virginia Route 172 from Poquoson Post Office to Cedar Road, 1.2 miles south along Cedar Road to the intersection with Canal Drive on the west side of Cedar Road back of curb, 67.9 feet south of VEPCO power pole DL-67 and 44.2 feet west of a 16 inch maple in the northwest corner of lot 231 Cedar Road.
RM 21	07	4.50	The bench mark is a Corps of Engineers Survey Mark Disk set in concrete about 1 inch below ground surface, stamped "Tidal BM No. 2 1975 Norfolk District." The mark is 0.02 mile east along Virginia Route 172 from Poquoson Post Office to Cedar Road, 1.5 miles south along Cedar Road to the intersection with Riverview Drive, back of the curb in the curved portion of the northeast corner of the streets, 25.3 feet west of VEPCO power pole EJ-11 and 17.5 feet south of VEPCO power pole EJ-41.

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EXHIBIT 1 - ELEVATION REFERENCE MARKS

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 22	07	4.85	The bench mark is a Corps of Engineers Survey Mark Disk set in concrete about 1 inch below ground surface, stamped "Tidal BM No. 1 1975 Norfolk District." The mark is 0.02 mile east along Virginia Route 172 from Poquoson Post Office to Cedar Road, 1.5 miles south along Cedar Road to the intersection with Riverview Drive and 239 feet east along Riverview Drive, 0.5 foot back of the north curb, and 0.5 foot east of a catch basin.
RM 23	07	11.070	The bench mark is located near the intersection of Poquoson Avenue and Poplar Road, at Poquoson High School, in the south face of the brick building, 30 feet east of the southwest corner, and about 5 feet above the ground (USGS D266 1942).
RM 24	07	7.5	The reference mark is a large nail in a power pole (VEPCO No. 475-48) located on the east side of Bunting Lane near Floyd Avenue between houses No. 33 and No. 37 Bunting Lane. The nail is about 8 inches above the ground.

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EXHIBIT 1 - ELEVATION REFERENCE MARKS

Reference Mark	FIRM Panel	Elevation (Feet NGVD)	Description of Location
RM 25	07	6.6	The reference mark is a large nail in a power pole (VEPCO No. JL69) located on the south side of Church Street at the intersection of Bunting Lane between houses No. 153 and No. 155 Church Street. The nail is about 1 foot above the ground.
RM 26	07	4.8	The reference mark is the top of a concrete monument located on the north side of Church Street at the intersection of Langley Street.
RM 27	09	9.154	The bench mark is located at the intersection of Poquoson Avenue and Church Street, at Trinity Methodist Church, in the east face of the building, 23.5 feet south of the northeast corner and about 5 feet above the ground (USGS F266 1942).

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